



**NOAA**  
**FISHERIES**

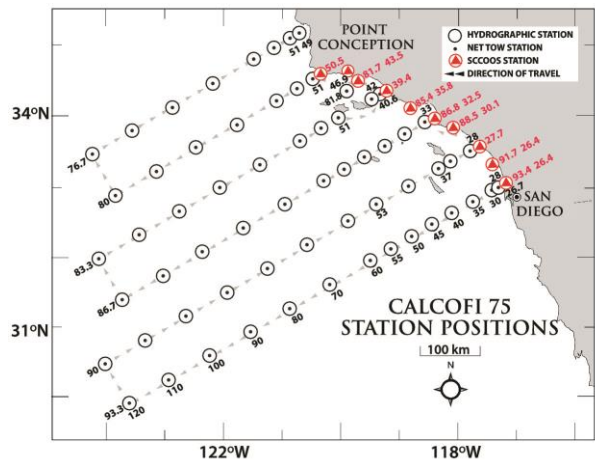
**SWFSC**

# 7.4 CalCOFI and Spring Sardine Surveys

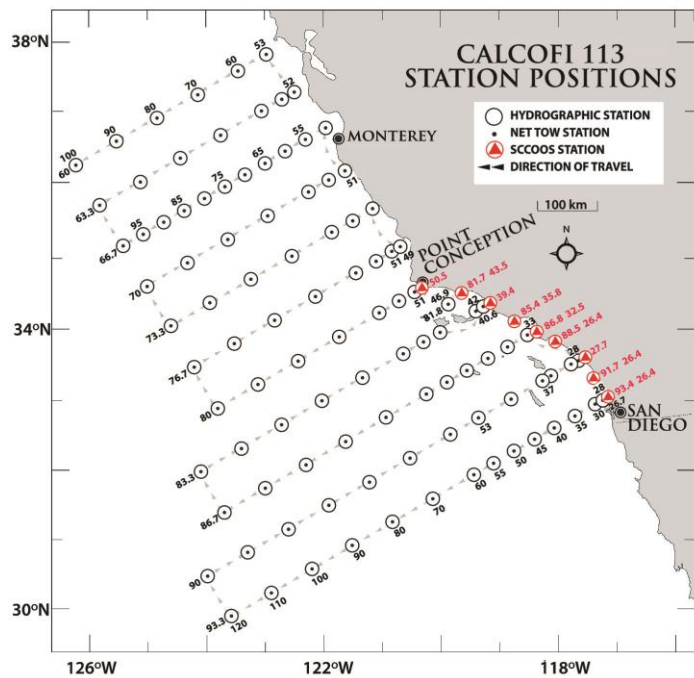
Sam McClatchie

- Overview of life-history data collected on CalCOFI and Spring Sardine surveys.
- How are the data managed?
- Issues with data management.

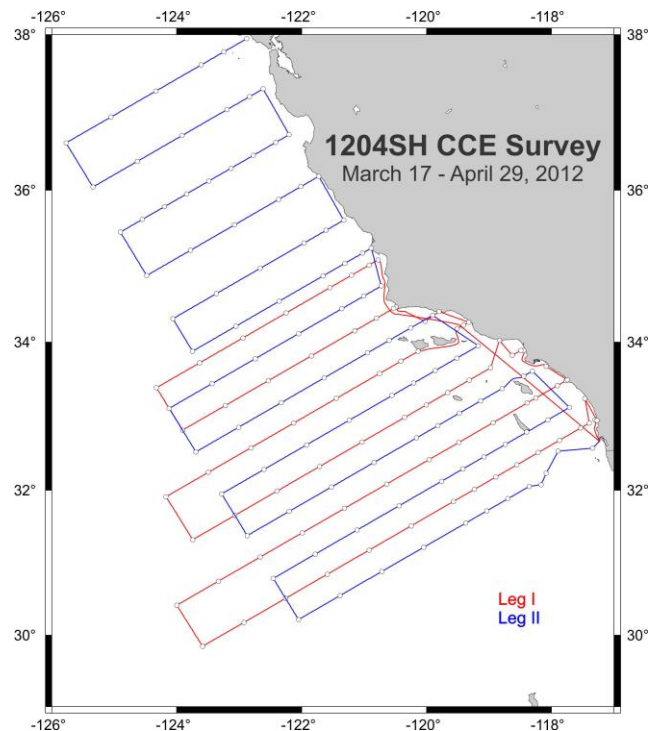
## Quarterly CalCOFI survey

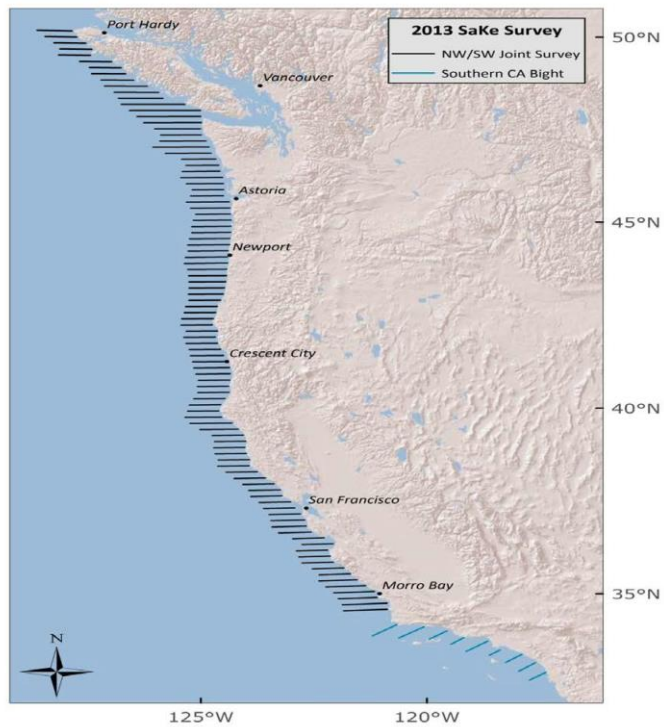


## Spring CalCOFI survey

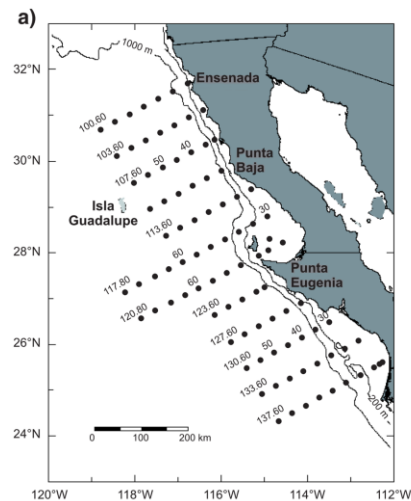


## Spring sardine survey

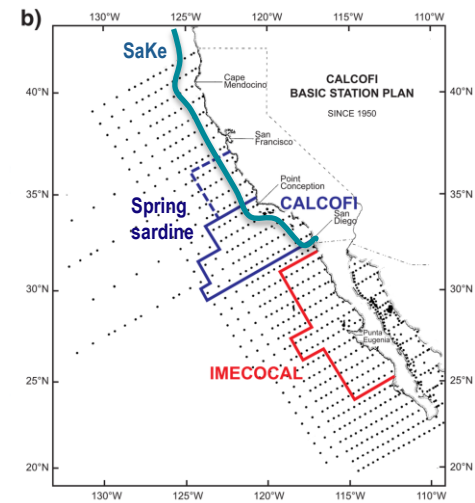




Summer SaKe survey



Quarterly IMECOCAL survey



Compare survey domains





# Surveys

# Goals



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# Spring Sardine Survey goals are focused on assessment

- Estimate the spawning stock biomass of Pacific sardine using the Daily Egg Production Method (DEPM).
- Estimate the total biomass of Pacific sardine using the acoustic/ trawl method.
- Estimate the confidence limits on the biomass estimates.
- Map the spatial distribution of Coastal Pelagic Species adults (and juveniles where possible).
- Map the spatial distribution of early life history stages (eggs and larvae) of Coastal Pelagic Species and the broader ichthyoplankton community.

# CalCOFI goals are much broader than assessment goals

- CalCOFI is focused on understanding the long-term changes in the California Current System (physical, biological & chemical).
- This goal is recognized as being intimately linked with basin-scale processes, and CalCOFI has been embedded in larger scale studies of the Pacific since its early days.
- The current focus of the CalCOFI program is now enabled by numerous other programs that piggy-back on and supplement the core survey program.
- CalCOFI provides the second longest marine time series in the world (currently 63 years).





# Surveys

# Sampling



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# Spring Sardine Survey. Categories of data

(data directly relevant to assessment are highlighted in red)

- Hydrographic
- Ichthyoplankton and zooplankton
- Reproductive, age and growth of Coastal Pelagic Species (CPS)
- Relative abundance and sizes of CPS
- Acoustic backscatter

9 science staff



# Spring Sardine Survey. Sampling by category

(data directly relevant to assessment are highlighted in red)

Hydrographic

**CTD Sensors:**      **Bottle Samples:**

Temperature

Conductivity      none

Oxygen

Ichthyoplankton &  
Zooplankton

**Nets & CUFES:**

Bongo net, 210m - all stations

Manta neuston net, all stations

Paironet vertical net to 70 m (or 5 m off bottom)

Continuous Underway Fish Egg Sampler (CUFES)

Acoustics &  
Trawling (for target  
ID & reproduction,  
growth)

Acoustics (5 frequencies)

Nordic trawl (back tracking to fish on acoustic fish marks)

# CalCOFI: Categories of data

(data directly relevant to assessment are highlighted in red)

- Hydrographic
- Ichthyoplankton and zooplankton
- Primary productivity, fractionations, POC/DOC, DIC
- Acoustics
- Mammal & seabirds

18 science staff (note that no trawling is done, which would require at least 3 more staff)

# CalCOFI: Sampling by category

## Hydrographic

### CTD Sensors:

Temperature

Conductivity

Oxygen

Fluorescence

Transmissometer

PAR

pH

### Bottle Samples:

Salinity

Oxygen

Nutrients

Primary Productivity

Chlorophyll-a

Phaeopigments

HPLC

DIC

LTER ancillary

## Ichthyoplankton & Zooplankton

### Nets & CUFES:

Bongo net, 210m - all stations

Manta neuston net, all stations

PRPOOS vertical net, lines 80 & 90, 86.7 & 83.3 coastal only

Paironet vertical net, 100m (coastal stations only to 70 m)

Continuous Underway Fish Egg Sampler (CUFES)

## Primary productivity, fractionations, POC/DOC, DIC, Acoustics, Birds and Mammals

### Supplementary Data:

SCS, Underway continuous surface and meteorological measurements

Primary Productivity, Daily C14-uptake incubations

Ancillary LTER, Plankton abundance, biomass, Chl a size fractionations, POC, DOC

Acoustics (5 frequencies)

DIC, 10 stations: 93.3-30, 90-90, 90-60, 90-53, 90-30, 86.7-35, 81.8-46.9, 80-55, 80-80, 80-90

Seabirds, Visual Observations

Cetaceans, Visual and Passive acoustic surveys







# Surveys

# Data management



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## How data are managed

- Data processing has developed on an “as needed” basis over many years.
- It is fair to say that there was a lack of coherent vision guiding the process.
- Documentation of data processing scripts was done retroactively and very late.
- Until the last 5 years, many datasets were held on individual scientists computers with no consistent data management or backup systems.
- Full integration of data into databases is still not complete (e.g. for the hydrographic data, or the trawl data from Spring sardine cruises).
- Data process improvement has been limited by hiring restrictions.
- Progress on serving data has leap-frogged improvement on processing the data.





Sea-going data logging, data entry, and data checking systems also need improvement. We are tackling these on a case by case basis. One example is the new CUFES interface shown here:

Cufes Client

Collection Started

Sample Number: 653

Start: 09/18/2012-10:22:25 Stop: / / - : :

Start Longitude: -123.2649 Stop Longitude: -

Start Latitude: 37.7290 Stop Latitude: .

Start Temperature: . Stop Temperature: .

Start Salinity: 33.086 Stop Salinity: .

Start Wind Speed: 20.22 Stop Wind Speed: .

Start Wind Direction: 326.4 Stop Wind Direction: .

Start Collection Collect Sample

Sardine Eggs Hake Eggs

Anchovy Eggs Squid Eggs

Jack Mackerel Eggs Other Fish Eggs

Comments

Add Record Reset

Create Database Open Database Disconnect SCS Get Current Position Line/Station Converter View Data View Map

/Users/edw/Documents/python/CufesClient/testdb/testcufes201204SH.sqlite

Improved data entry

Current Position

Longitude: -123.2659 Line: 60.179

123° 15' 57" W

Latitude: 37.7300 Station: 55.595

37° 43' 47" N

Line/Station Converter

Longitude: -121.15 Line: 80.0

Latitude: 34.15 Station: 60.0

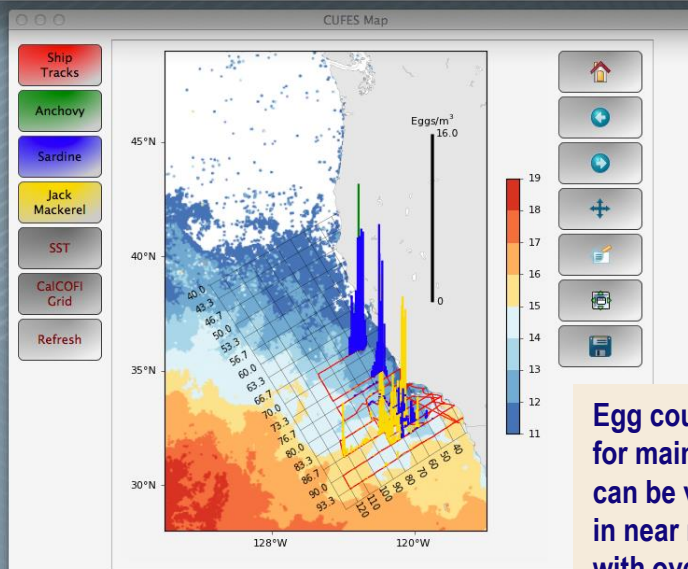
CUFES Data

	Start	StartLatitude	StartLongitude	StartLine	StartStation	StartTemperature	StartSalinity	StartWindSpeed
18	03/25/2012-20:48:09	32.1434	-118.896	93.45	50.30	14.0472	33.3807	22.55
19	03/25/2012-21:30:18	32.096	-119.014	93.41	51.95	14.2624	33.376	24.51
20	03/25/2012-22:01:25	32.0601	-119.102	93.37	53.20	14.1774	33.3627	28.89
21	03/26/2012-00:52:50	31.9988	-119.261	93.30	55.41	14.2646	33.3652	17.8
22	03/26/2012-01:34:56	31.9391	-119.381	93.30	57.20	14.5032	33.3953	15.6
23	03/26/2012-02:09:56	31.8892	-119.485	93.30	58.72	15.0001	33.454	12.96
24	03/26/2012-04:47:56	Sample time > 2 hours 19.616	93.19	60.47	14.784	33.4317	9.04	
25	03/26/2012-05:33:55	31.7763	-119.757	93.21	62.58	14.7329	33.425	12.85
26	03/26/2012-06:14:56	31.7071	-119.892	93.22	64.60	14.5481	33.4312	12.94
27	03/26/2012-06:59:55	31.6279	-120.039	93.25	66.83	13.5291	33.4078	15.85
28	03/26/2012-07:30:28	31.5734	-120.139	93.27	68.35	13.6506	33.4344	11.9
29	03/26/2012-10:21:19	31.5039	-120.299	93.23	70.65	13.6399	33.1748	7.35

Selection Mode Copy Paste Record(s) Delete Record(s) Print Save Send to Shore Upload to DB

Facilitates error checking

Data can be sent to shore in correct format with one click




Egg count data for main species can be visualized in near real time with overlay of satellite imagery






**Data serving:**  
**IchthyoDB**  
provides a user-friendly GUI for data selection and download of the entire ichthyoplankton database (all species). Metadata are provided on the web pages.



# IchthyoDB - Egg and Larvae Counts

currently connected to the **local** database (logout)



## Tow Type Filters

☒ Oblique ☐ Vertical ☐ Surface ☐ Depth Stratified

☒ Restrict to tows from CalCOFI cruises

## Time Period Filters

Year  ☐ invert to

Month  ☐ invert to

Time  ☐ invert to

## Species Filters

Search All Fields

<input type="checkbox"/> <u>Code</u>	Scientific Name	Common Name	Type	Occurrences
--------------------------------------	-----------------	-------------	------	-------------

## Geographic Filters

☒ By Latitude/Longitude   
  
☐ By Line/Station


Note: Use decimal latitude and longitude, with negative values for south and west values respectively. Sensitive to 5 decimal places.

## Species Distribution

Limit to counts >=

☒ Show zero tows

☒ Show CalCOFI stations ☒ Color points by count



POWERED BY Google  
Imagery ©2013 TerraMetrics - Terms of Use



## Output Options

Unit:  Format:  ☒ Include zero tows

## Data Download

[Search Interface](#) • [About this Project](#) • [Help and Documentation](#) • [References](#)

Data serving:  
IchthyoDB will  
soon be  
discontinued in  
favor of a more  
sophisticated  
interface.

## IchthyoDB - Egg and Larvae Counts

**Note:** Numbers and densities of eggs captured provide indices of abundance that are unique to each tow type. So, for example, number of eggs captured in an oblique tow should never be compared with number of eggs captured in a vertical tow. Several other important changes have occurred in sampling methods for collecting ichthyoplankton. In 1969, tow depths extended from 140 m to 210 m, and nets were changed from 0.55-mm-mesh silk to 0.505-mm-mesh nylon. In 1977, oblique tows were changed from using 1-m bridled ring nets (denoted C1 in the data) to 0.71-m bridleless bongo nets (denoted CB). See Hewitt 1980, Brinton and Townsend 1981, and Ohman and Smith 1995 (References, below) for details.

### Summary

<b>Unit:</b>	Count
<b>ShortTowType:</b>	C1,CB
<b>CruiseTypeCode:</b>	C
<b>Line:</b>	77-93
<b>Station:</b>	35-100
<b>Year:</b>	2011-2011
<b>Month:</b>	3-5
<b>TowBegin:</b>	0:00-24:00

### Taxonomies

CalCOFI #	ITIS #	Scientific Name	Common Name	Type
9555	82406	Abraia		Larvae
9556	556021	Abraia trigonura		Larvae
9560	82398	Abraiaopsis		Larvae
Identified: 2008-present				
Notes: Some taxa identified to various levels in some samples prior to 2008				
9559	82402	Abraiaopsis affinis		Larvae
9561	82401	Abraiaopsis felis		Larvae
Identified: 2008-present				
Notes: Some taxa identified to various levels in some samples prior to 2008				
9562	82398	Abraiaopsis sp A		Larvae
9563	82398	Abraiaopsis sp B		Larvae
Identified: 2008-present				
Notes: Some taxa identified to various levels in some samples prior to 2008				
623	170045	Abudefduf	Sergeant majors	Larvae
621	615041	Abudefduf declivifrons	Mexican nightsergeant	Larvae
622	170054	Abudefduf troschelli	Panamic sergeant major	Larvae
576	172451	Acanthocybium solandri	Wahoo	Larvae
585	172250	Acanthuridae	Surgeonfishes	Larvae
2190	172251	Acanthurus		Larvae

### Codes

Type	Code	Definition
Cruise	C	CALCOFI
Tow	CB	CALCOFI Oblique Bongo Tow
ErrorCode	0-19	SWFSC Tow Quality

### References

Brinton, E., and A. W. Townsend. 1981. A comparison of euphausiid abundances from bongo and 1-M CalCOFI nets. Calif. Coop. Oceanic Fish. Invest. Rep. 22:111-125. (PDF)

Hewitt, R.P. 1980. Distributional atlas of fish larvae in the California Current region: northern anchovy, Engraulis mordax Girard, 1966 through 1979. Calif. Coop. Oceanic Fish. Invest. Atlas 28:1-101 (PDF)

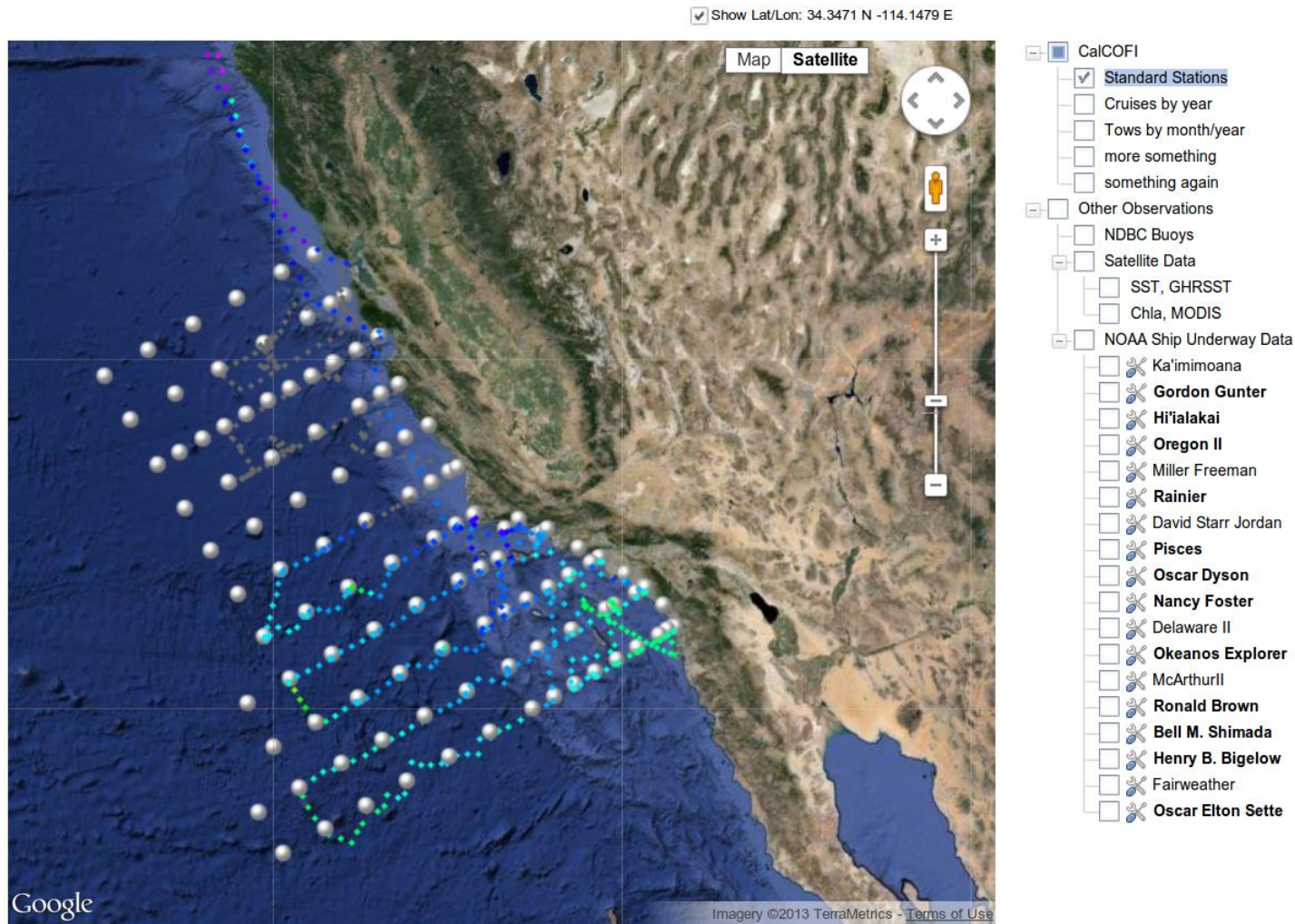
Kramer, D., M.J. Kalin, E.G. Stevens, J.R. Thrallkill and J.R. Zweifel, 1972. Collecting and processing data on fish eggs and larvae in the California Current region. NOAA Technical Report NMFS CIRC-370. (PDF)

Ohman, M. D. and P. E. Smith. 1995. A comparison of zooplankton sampling methods in the CalCOFI time series. CalCOFI Rep. 36:153-158. (PDF)

Smith, P.E. and S.L. Richardson, 1977. Standard techniques for pelagic fish egg and larva surveys. FAO Fisheries Technical Paper, (175):100 p. Issued also in Spanish (PDF)

NOAA Southwest Fisheries Science Center - Gear Descriptions

# Data serving: The new system is being developed through ERDDAP



Spring 2013 CalCOFI and spring sardine survey colored by temperature from vessel SES

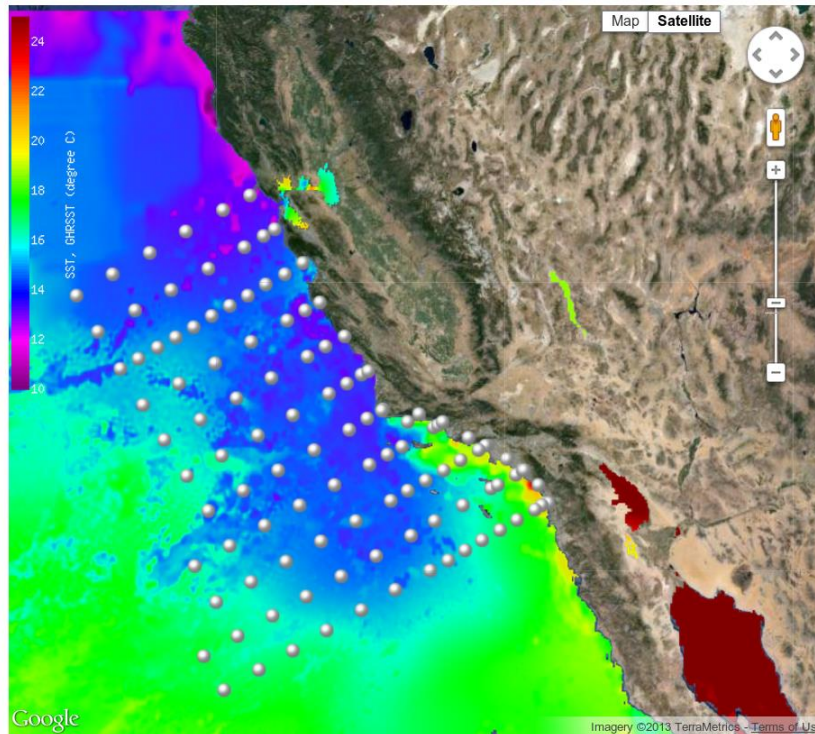


# Data serving: ERDDAP

Overlays of remotely sensed SST and ocean color

GHRSSST Global 1-km Sea Surface Temperature Jun 23 2013 17:00 GMT

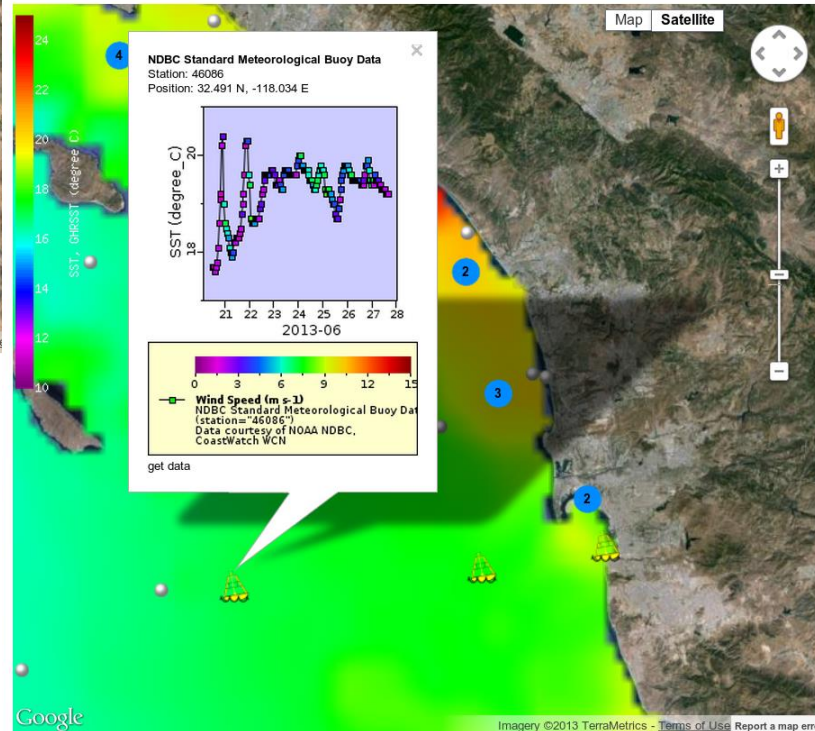
Show Lat/Lon: 38.1311 N -112.1265 E



- ☒ CalCOFI
  - ☒ Standard Stations
  - ☐ Cruises by year
  - ☐ Tows by month/year
  - ☐ more something
  - ☐ something again
- ☒ Other Observations
  - ☒ NDBC Buoys
  - ☐ Satellite Data
    - ☒ SST, GHRSSST
    - ☐ Chla, MODIS
- ☐ NOAA Ship Underway Data
  - ☐ Ka'imimoana
  - ☐ Gordon Gunter
  - ☐ Hi'ialakai
  - ☐ Oregon II

GHRSSST Global 1-km Sea Surface Temperature Jun 23 2013 17:00 GMT

Show Lat/Lon: 29.4587 N -117.5537 E



- ☒ CalCOFI
  - ☒ Standard Stations
  - ☐ Cruises by year
  - ☐ Tows by month/year
  - ☐ more something
  - ☐ something again
- ☒ Other Observations
  - ☒ NDBC Buoys
  - ☐ Satellite Data
    - ☒ SST, GHRSSST
    - ☐ Chla, MODIS
- ☐ NOAA Ship Underway Data
  - ☐ Ka'imimoana
  - ☐ Gordon Gunter
  - ☐ Hi'ialakai
  - ☐ Oregon II
  - ☐ Miller Freeman
  - ☐ Rainier
  - ☐ David Starr Jordan
  - ☐ Pisces
  - ☐ Oscar Dyson
  - ☐ Nancy Foster
  - ☐ Delaware II
  - ☐ Okeanos Explorer
  - ☐ McArthur II
  - ☐ Ronald Brown
  - ☐ Bell M. Shimada
  - ☐ Henry B. Bigelow
  - ☐ Fairweather
  - ☐ Oscar Elton Sette

Ancillary data from buoys

Directly linked to  
ERDDAP data  
serving GUI

Data are  
queriable from  
within analysis  
programs (like R,  
Matlab, NCL)  
using Opendap  
protocol to access  
data on remote  
servers.

Coming soon:  
Full access to all  
63 years of  
CalCOFI  
ichthyoplankton  
and hydrographic  
data.

## ERDDAP > [tabledap](#) > Make A Graph

Dataset Title: **NDBC Standard Meteorological Buoy Data**  

Institution: NOAA NDBC, CoastWatch WCN (Dataset ID: cwwcNDBCmet)

Range: longitude = -177.75 to 179.001°E, latitude = -27.705 to 71.502°N, time = 1970-02-26T20:00:00Z to (now?)

Information: [Summary](#) | [License](#) | [FGDC](#) | [ISO 19115](#) | [Metadata](#) | [Background](#) | [Subset](#) | [Data Access Form](#)

Graph Type: **linesAndMarkers**

X Axis: **time**

Y Axis: **wtmp**

Color: **wspd**

Constraints

**time**

**station**

Optional  
Constraint #1

**>=** 2013-06-20T11:33:43Z

**=** "46086"

"46086" **-** **+**

**>=**

**>=**

**>=**

Optional  
Constraint #2

**<=**

**<=**

**<=**

**<=**

**<=**

**<=**

Server-side Functions

☐ **distinct()**

**orderBy** (" **time** **asc** ")

Graph Settings

Marker Type: **Filled Square** Size: **5**

Color: 

Color Bar: **time** Continuity: **on** Scale: **linear**

Min: **17** Max: **21** N Sections: **1**

Y Axis Minimum: **17** Maximum: **21**

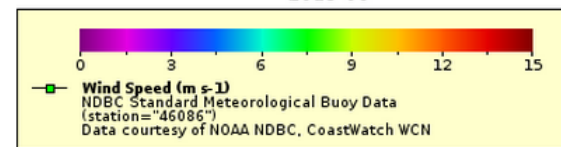
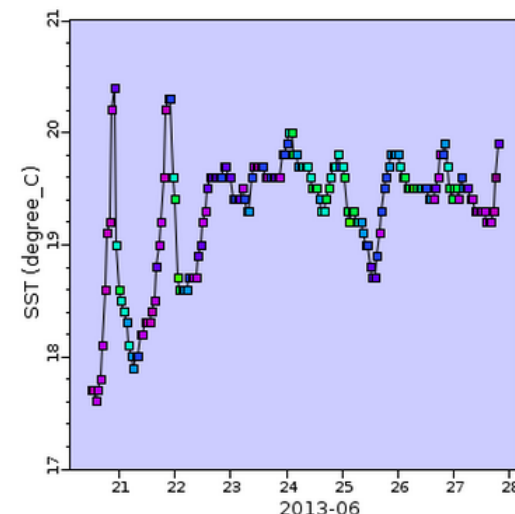
**Redraw the Graph** (Please be patient. It may take a while to get the data.)

Optional:

Then set the File Type: **.nc** and **Download the Data or an Image**

or view the URL: <http://coastwatch.pfeg.noaa.gov/erddap/tabledap/cwwcNDBCmet>

([Documentation](#) / [Bypass this form](#)) ([File Type information](#))



# Summary

## 1. Strengths

- Methods are well established, refined and validated. The process of improvement was documented in peer-reviewed publications.
- Continuity of long time series where changes have been well tested against established methods before change is adopted.
- Efficient teams with many years of experience with the surveys.

## 2. Main challenges

- How to modernize and improve the existing data systems in the face of retirements without replacements.
- Restructuring the databases (e.g. to move from fixed-format to date-time and spatial data classes).
- How to meet the increasingly heavy demands of surveys for staff and financial resources.
- How to best incorporate new technologies to increase spatial and temporal sampling resolution.
- How to balance the demands of stock assessment with the need for data informing broader climate and ecosystem issues.



# Summary continued

## 3. Strategies for improvements (i.e., to address the challenges)

- Piecemeal data processing procedures need to be modernized, integrated and streamlined.
- Legacy software and scripts need to be replaced while maintaining continuity.
- The old processing systems need to be run in parallel with a new system prior to replacement with a new system.
- A programmer should be hired on a term position with the explicit goal of designing and implementing a new data system.
- The task should be carefully focused to deal with critical issues first, to overcome bottlenecks, reduce risks, and to make sure that goals are achieved.
- Efficient but parallel data streams for hydrographic, ichthyoplankton, trawl, and acoustic data will likely be necessary, up to the point where the data are served through a system like ERDDAP.